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METHOD AND SYSTEM FOR ACOUSTICAL FUNCTION  
CONTROL IN A MOTOR VEHICLE

## Background Information

The present invention relates to a method and a control system for acoustical function control in a motor vehicle using a speech input system that receives spoken commands and converts them into corresponding control signals, the system being activated by an operational element that is manually activated and, upon being activated, outputting to an operating person the indication of readiness to receive a spoken command.

Currently, speech input systems must be activated by the user shortly before the inputting of a relevant voice command. A so-called "Push-To-Talk" activation of this type is usually carried out by a push-button on the steering wheel rim. The system must signal back to the user when it is ready to respond to his command, i.e., provide a readiness indication. It is known to realize this indication of readiness using a color change of an optical symbol on a display or using a short, one-time tone. Because in actual urban driving, the use of voice inputting is usually a secondary task, after the safe driving of the vehicle, and the driver is often subject to significant mental stress by the actual task of driving, he can overlook the optical symbol indicator on the display, it is possible for him not to hear the acoustical check-back signal, or he can forget that the check-back signal has already taken place. As a result, he is uncertain with regard to the condition of the system, which can lead to operating errors, faulty functioning, and consequently to a lack of acceptance by the user of a function control system that operates on the basis of voice input in a motor vehicle.

## Objective and Advantages of the Invention

It is the objective of the present invention to make possible a method according to the species and a control system according to the species, such that voice-input function control in the motor vehicle is simplified and its functional reliability increased. At the same time, the goal is to achieve clarity in a simple manner concerning the condition of the system without requiring a glance and without annoying the passengers, and to increase the acceptance of speech input systems of this type for function control in a motor vehicle.

It is also an objective of the present invention to indicate a combined operating/indicator element that is suitable for the control system according to the present invention.

As a result of the fact that the indication of the readiness condition is effected by a mechanical deflection from a preestablished position of the combined operating/indicator element, or a part thereof, in an immediate response to the tactile sensation of the operating hand of the operating person, the driver is constantly informed concerning the condition: *Ready* or *Not Ready* of a speech input system, without having to cast his glance at a particular display. In addition, in this manner, the correct time for a voice command is clearly signaled to the driver so that the recognition rate of the voice recognition in the speech input system is improved.

After a valid voice command is recognized, the control system for its part can indicate that it is at present no longer ready to input a further command. For this purpose, the combined operating/indicator element, or the part thereof, can once again be set in its original condition.

The readiness indication as a result of the mechanical deflection of the operating/indicator element, or a part

thereof, can be effected statically, in that the operating/indicator element, or part thereof, experiences a static change in shape or position during the readiness condition of the control system.

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In the exemplary embodiment, if the operating/indicator element is embodied by a switch or key on the steering wheel rim, it is possible, for indicating readiness, to recess the push-button or the sliding head of the key or switch, which  
10 was pressed by the driver to activate system, so far into the housing that the finger of the operating hand senses a depression or opening in the housing. This static change in shape of the operating/indicator element suggests to the user that the system is "opened" like a door. This analogy can be  
15 taken even further if the operating/indicator element is given the shape, e.g., of a raised ear, and the readiness to hear, i.e., to receive a spoken command, is signaled by a lowering of the ear. This, in turn, is brought about by the control system.

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An alternative possibility is not to change the shape or position of the operating/indicator element, or a part thereof, statically during readiness, but to set the operating/indicator element, or a part thereof, in vibration  
25 to indicate readiness. In the meaning of the present invention, a vibration is also to be understood as a deflection of the operating/indicator element or a part thereof.

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According to the currently preferred embodiment, the combined operating/indicator element is a key or switch that can be installed on the steering wheel of a motor vehicle, whose movable part, i.e., whose key or switch sliding head, is placed in vibration or is moved in order to indicate the  
35 readiness condition using an electromotor, electromagnetic, or piezoelectrical actuator organ located in the interior of the

operating/indicator element. In place of this, it is also possible to use other known actuators.

Below, on the basis of the drawing, a currently preferred exemplary embodiment of the method according to the present invention and of the control system are described, as well as a combined operating/indicator element designed for the control system.

#### 10 Drawing

Figure 1 schematically depicts a basic system structure of a control system for acoustical function control in accordance with the present invention, and

15 Figures 2 A-C depict function-time diagrams, which illustrate the basic time curve of the functions of the control system depicted in Figure 1.

#### 20 Exemplary Embodiment

Figure 1 depicts schematically and in the form of function blocks a control system for acoustical function control in a motor vehicle, generally designated as reference numeral 1.

25 Via a microphone 16, a speech input system that is made up of a voice recognition block 10 and a control block 11, control system 1 in the activated condition can receive spoken commands from an operating person and can convert them into control signals for controlling various functions in the motor vehicle as well as, if appropriate, also around the motor vehicle.

Before the input of a relevant voice command by the user, the system is activated by the pressure of the finger of his hand on a key or switch sliding head 13 of a key or switch 12 secured on steering wheel rim 15, the key pressure or

switching operation being conveyed to control block 11 of system 1 as an activating signal.

Control block 11, depicted in Figure 1, functions to control voice recognition block 10, to activate microphone 16, to input the switching condition of operating element 12, and to actuate the sliding head for the readiness indication, or for triggering the vibration.

System 1, or control block 11 of the speech input system, signals back to the user when it is ready to respond to his voice command, i.e., it delivers a readiness indication. For this readiness indication, after combined operating/indicator element 12 has been actuated by the user, e.g., through finger pressure, to activate the system, the element is brought by control block 11 of system 1 into a condition which can be detected by the same finger, or by other parts of the hand of the user in a direct tactile manner. For this purpose, in the exemplary embodiment, sliding head 17 of key 13, extending into the interior of operating/indicator element 12, which was pressed by the driver for the purpose of activation, is retracted, e.g., by an electromagnet 14 upon a signal from control block 11, so far into the housing of operating element 12 that the finger senses a depression or opening in the housing. A signaling of this type for the readiness condition clearly suggests to the user that the system is "opened" like a door.

As was mentioned, this analogy can be taken even further, by giving to the combined operating/indicator element the shape of an ear and by signaling the readiness of the system to respond, i.e., to accept voice commands, by a lowering of the ear.

In place of using an electromagnet or electromotor 14 in the interior of operating/indicator element 12, for retracting and holding sliding head 17 of key 13 in the interior of the

housing, it is also possible to use piezo actuators and other similar known actuators.

An alternative configuration, which is not specifically depicted in Figure 1, can set key 13 in vibration in order to indicate readiness. In this case as well, the operating/indicator element, during the readiness of system 1, experiences a mechanical deflection, which is detectable as vibration in a directly tactile manner.

The function-time diagrams depicted in Figures 2A-2C indicate in principle the time curve of functions of the version of control system 1 depicted in Figure 1, whose operating/indicator element is furnished with projecting/retracting key 13 and sliding head 17.

Part A of Figure 2 depicts the activation of key 13 of operating/indicator element 12 by the finger of the user, the closing of the contact of the key, the inputting into control block 11, and the activating of voice recognition block 10. In central part B, Figure 2 shows that, after the activation, the system signals its voice input readiness by retracting sliding head 17 and with it key 13 into the housing of operating/indicator element 12. Double arrow T thus indicates duration T of the readiness condition of the system. During readiness condition T, the user can input a voice command into system 1 via microphone 16 in accordance with lower part C of Figure 2. Voice recognition block 10 recognizes the spoken command and converts it into corresponding control signals for various control tasks inside the motor vehicle, not specified in any greater detail, or optionally outside the motor vehicle (e.g., opening a garage door).

After the voice command of the user input into microphone 16 has been recognized by voice recognition block 10 and has been converted into the corresponding control signals, system 1 once again indicates via control block 11 and

operating/indicator element 12 that it is at present no longer ready for the inputting of a further command. For this purpose, in accordance with central part B of Figure 2, operating/indicator element 12, or its key 13, is once again set in its original condition. In the depicted exemplary embodiment, the head of key 13 once again extends out of the housing of the operating/indicator element. In the alternative example, the vibration of the key then ceases.

10 In the method according to the present invention for acoustical function control in a motor vehicle, depicted above by way of example, as well as in the control system designed for this purpose, the driver is constantly informed concerning the condition of the speech input system, without having to specially direct his glance to a display. The driver can therefore direct his eyes and attention to the events on the road, parallel to inputting a spoken command. The driver senses through his hand in a direct, tactile manner the correct time for a voice command, as a result of which the recognition rate of the speech input system is not impaired.

The driver can always form a correct picture of the condition of the speech input system, so that he feels more secure in the dialogue with the speech input system and is no longer hampered in his driving performance by irritation. Passengers are not affected by this form of providing information.

## Abstract

The present invention relates to a method and a control system for acoustical function control in a motor vehicle using a speech input system (10, 11) that receives a spoken command and converts it into corresponding control signals, the system being activated by an operating element (12) that is actuated manually and, upon being actuated, outputting to an operating person an indication of its readiness to receive a voice command, wherein the indication is effected by a mechanical deflection from a preestablished position of the operating element (12), or a part (13) thereof, so as to directly influence the tactile sense of the operating hand of the operating person (Figure 1).